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RENESAS

H8S/H8SX Families

Using the Graphics API to Implement Sliding Icons and Transparency

Introduction

Renesas provides a standard set of functions for creating and manipulating graphics and text on a TFT-LCD panel. These functions are referred to as the Graphics Application Programming Interface or GAPI.

This Application Note is one in a series of application examples which show how to implement interactive graphics on an LCD panel.

This Application Note can be used with any available Direct Drive LCD Demo PCB from Renesas.

Design manuals, software and schematics are also available from www.america.renesas.com/h8lcd.

This application note must be used in conjunction with the REU05b0112_H8SAP application note and code. Please download and install REU05b0112_H8SAP application note first and use the below instructions to add this source code to the project.

Target Device

H8S2378, H8S2456, H8SX1668R

and Direct Drive LCD Demo Board

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1. Transparently moving a bitmap on the screen

This sample code uses GAPI calls which will access the bitmap in memory and move it randomly about the screen.

This code also maps the bitmap to a touchable area based on its size, and specifies which function will be called in the event that the icon is touched.

This code moves the icon by drawing each image from the bitmap on a periodic basis.

Figure 1 shows the bitmap that we will be moving about the screen in the sample code:

Figure 1 BigR.BMP and ScreenBounce

1.1 Creating a transparent BMP compatible with GAPI

There are many tools that can create bitmap images compatible with GAPI. In this example we will use Adobe Photoshop® (raster editor) and Adobe Illustrator® (vector editor) to create a standard bitmap file image that we can use within GAPI. Often these tools are used in a corporate environment for high quality logos and images. In this case we wish to use the stylized “R” from the Renesas logo. The advantage of the .ai format is that it is vector based and can easily be scaled to any pixel size without loss of information (pixelization). To start we will scale our logo to the desired pixel size in the vector editor, and then copy this to the raster editor.

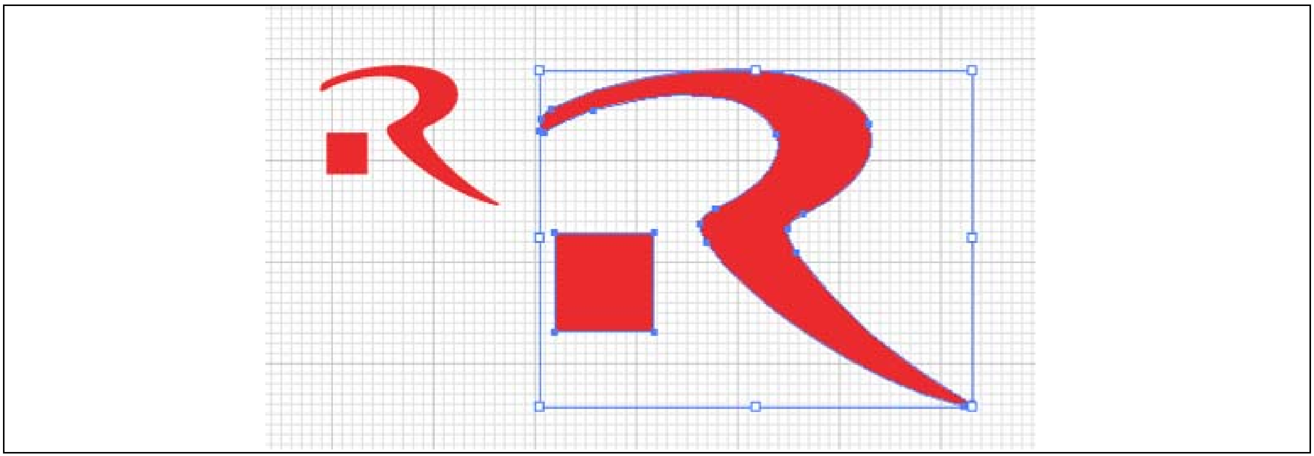


Figure 2 Vector Logo

When starting your image in the raster editor, start with an RGB color 8:8:8 image with transparent background. Paste the copied vector image into the raster editor. Make sure “anti-alias” is off for this process…this will provide solid edges that will blend against a random background. Next, we will convert the image mode to “indexed color” (image->mode->indexed color, merge layers OK. Depending on your particular image, the number of colors will vary, but ensure that “transparency” is checked in the creation of the color table (GAPI utilizes this transparency). You can now “save as” a standard bitmap (BMP) file. Given this file only has 4 colors in the color table, it can be saved as either a 4Bpp or 8Bpp indexed BMP format (GAPI supports both 4Bpp and 8Bpp indexed formats). Locating this file in the demo’s “Resources” directory will automatically cause it to be built into the “resources.bin” file with all other demo resources (refer to the REU05b0112 for more information on resources).

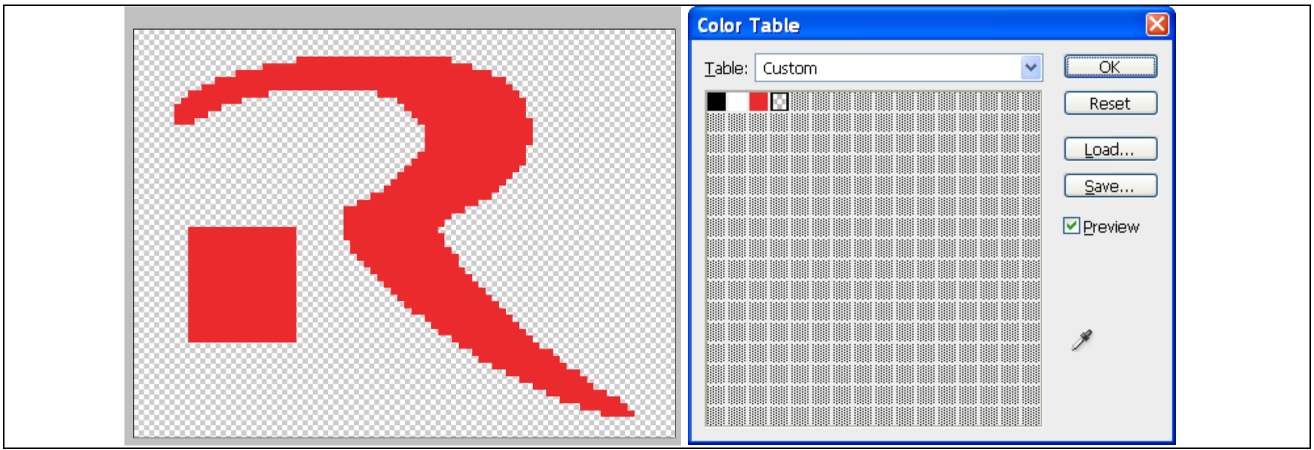
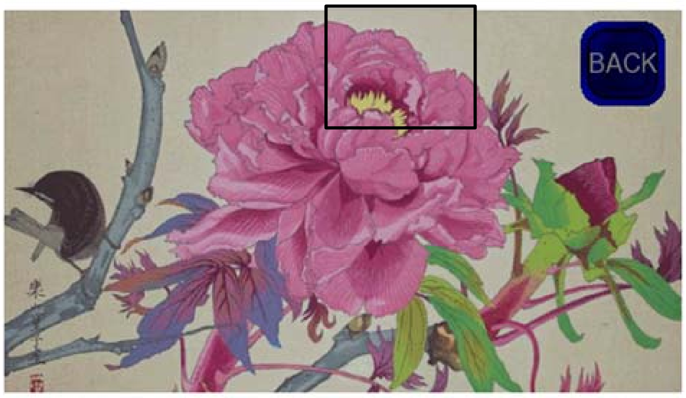


Figure 3 Raster Logo and color table

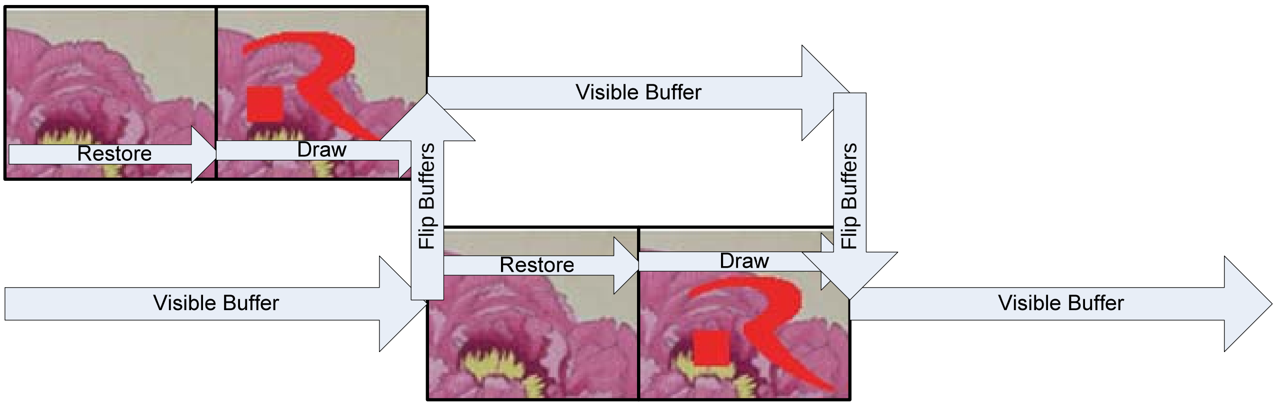
1.2 Animation by page flipping

There are many techniques that can be used to transparently move an image on a screen. In this demonstration we use a page flipping technique as illustrated below. When moving an image against a complex background, the prior location of the image must be restored before painting the image again in the new location. In this demo, we keep a reference frame (backFramebuf) that is used to restore corrupted areas. If we were to use a single buffer we would visually see the draw/restore/draw process and perceive "flicker" as sometimes we would see the restored area that was about to be drawn again. By using two buffers, we perform the restore/draw process on a non-visible buffer, then flip (make visible) this buffer only after completing the process. At this time, the previously visible buffer is available for the restore/draw process. To minimize the time consumed in the restore/draw process only the frame regions that are known to be affected are written to.



backFrameBuf (restore source)

Simple use of single frame buffer (flicker)



Page flipping with two frame buffers (no flicker)

2. Code

2.1 Setting Up the Icon

The Icons table describes which objects will be placed on the screen. The pBigR image will be placed at screen coordinates x = 0.0, y = VERTICAL_POS_PCT (0.396) (relative screen coordinates) when the "BasicConstructor" processes the "BounceLogo" callback function.

Any number of icons can be placed on the screen; the final entry in the table must be a NULL to terminate the list.

```
static const ICON_type Icons[]=
{
//*****************************************************************************
//BITMAP ADDR                            FUNCTION CALL            Y POSITION
//                      COLOR SCHEME                       X POSITION
//*****************************************************************************

  { &pBMP_ButtonS, T_SchemeBlue,   ButtonBack,     SX(0.850), SY(0.750) },
  { &pBMP_BigR,    T_SchemeNoColor,BounceLogo, SX(0.000),   SY(VERTICAL_POS_PCT)   },
  { NULL,              NULL,           NULL,           0,        0      },};

SCREEN_type ScreenHomeData=
{
  Constructor, Destructor, Icons
};
```

2.2 Screen Constructor/Destructor

Every screen is started by the framework calling the screen Constructor. In this sample code, the constructor first locates the "BigR" (BMP) file in the pResources structure and assigns this location to the "pBMP_BigR" handle. When the "BasicConstructor" is called, it will execute each Icon table callback function (these functions are responsible for placing their own graphic images). The BasicConstructor initializes the displayFrameBuf, but this code also utilizes the workFrameBuf for page flipping, so this code also initializes the workFrameBuf with a GAPI LCDBMPCopy call. Because we will be moving our BigR icon about the screen, we didn't place it into the backFrameBuf (as it would be copied to the displayFrameBuf during the restore process). So initial placement of the BigR in the displayFrameBuf is accomplished by a GAPI LCDBMPCopyTransparent call.

The "Destructor" function is called on exit from the screen by the framework. The "BasicDestructor" will release the screen task that we will be using.

```
static void Constructor(SCREEN_type const *pS)
{
  if(pBMP_Background == NULL)
    pBMP_Background = FileFind(pResources, "TestImage8bpp");

  if(pBMP_BigR == NULL)
    pBMP_BigR = FileFind(pResources, "BigR");

  //fill background
  (void)LCDBMPCopy(pBMP_Background, backFrameBuf, 0, 0);

  // Run default behavior
  BasicConstructor(pS);

  //initialize work frame buffer
  (void)LCDBMPCopy(backFrameBuf, workFrameBuf, 0, 0);

  //Display icon. BasicConstructor() would take care of this
  //normally, but since we are flipping buffers for animation it must
  //be drawn manually to the front buffer.
  (void) LCDBMPCopyTransparent(pBMP_BigR, displayFrameBuf, x_pos,   y_pos);
}

static void Destructor(SCREEN_type const *pS)
{
  // Run default behavior
  BasicDestructor(pS);
}
```

2.3 Callback function

The "BounceLogo" function will be called on every event that the system receives while this sample screen is active. It is the responsibility of this function to decide if it needs to process the event.

When "BounceLogo" is called by the "BasicConstructor", it will be passed a message ID of "MSG_DRAW". When this message is received we reset the "running" flag of the "BounceTask" (as all screen tasks are stopped on a screen change).

When "BounceLogo" is called because of touch events, it will check if the "BounceTask" is "running". If not, and the touch was within the boundary of the BigR, it will process "MSG_RELEASE" ID's. If so, we will start the "BounceTask" screen task responsible for periodically moving the image. If "BounceTask" is already "running", a "MSG_RELEASE" event anywhere on the screen will stop it.

```
void BounceLogo(ICON_type const *pS, EVENT_MSG const *pMsg)
{
  if(MSG_DRAW == pMsg->id)
  {
    /* reset state of icon */
    running = 0;
  }

  if(0 == running)
  {
    //press the logo to start the task
    //we want to check if the logo has been touched, but we do not want IconHandler()
    //to draw the logo for us.  That is being handled separately.
    if (((x_pos <= pMsg->param.coord[0]) &&
              (pMsg->param.coord[0] < (x_pos + BMP_Width(*pS->ppBmp)))) &&
        ((y_pos <= pMsg->param.coord[1]) &&
              (pMsg->param.coord[1] < (y_pos + BMP_Height(*pS->ppBmp)))))
    {
      if (MSG_RELEASE == pMsg->id)
      {
        //start screen task
        (void)ScreenTaskStart(BounceTask);
        running = 1;
      }
    }
  }
  else
  {
    //pressing anywhere else will stop the task
    if (MSG_RELEASE == pMsg->id)
    {
      //stop screen task
      (void)ScreenTaskStop(BounceTask);
      running = 0;
    }
  }
}
```

2.4 Moving the Bitmap

The “ BounceTask” function is called on a periodic basis (determined by the xDelay return value…50mS here). Because code in this thread will be accessing the external bus, we must “window” the usage with “ExMemoryAcquire” and “ExMemoryRelease” to prevent conflict with the direct driver.

First the code calculates a new x,y coordinate pair for the icon. This code just adds a fixed value (RATE) via “_move” variables, the sign of these variables is changed whenever the icon “bumps” against a screen edge to keep the “BigR” within the screen boundaries.

The code than restores the “clean” area from the backFrameBuf to the workFrameBuf by use of the GAPI LCDBMPCopySub call. This restoration only copies an area as big as the BigR bitmap. Then the BigR is painted at the new location with the GAPI LCDBMPCopyTransparent call.

Finally the code “flips” the display with the GAPI LCDBMP_WorkDisplay call (making workFrameBuf the displayFrameBuf and displayFrameBuf the workFrameBuf)

```
static TickType BounceTask()
{
  // Update image at 20Hz
  TickType xDelay = (TickType)(50/TICK_RATE_MS);

  /* Let system know we're accessing External Memory */
  ExMemoryAcquire(RLCD_GetTaskHandle());
  {
    //index of the currently active frame
    static sI16 index = 0;

    //this array hold previous x and y coordinates for each buffer
    static POINT_TYPE prev[2] = { {SX(0.000), SY(VERTICAL_POS_PCT)},
                                  {SX(0.000),   SY(VERTICAL_POS_PCT)} };

    //width and height of the image
    sI16 img_width = BMP_Width(pBMP_BigR);
    sI16 img_height = BMP_Height(pBMP_BigR);

    {
      /* move icon */
      static sI16 x_move=RATE, y_move=RATE;
      x_pos+=x_move;
      if (x_pos < 0)
        x_move = RATE;
      else if(x_pos > BMP_Width(backFrameBuf)-img_width)
        x_move = -RATE;

      y_pos+=y_move;
      if (y_pos < 0)
        y_move = RATE;
      else if(y_pos > BMP_Height(backFrameBuf)-img_height)
        y_move = -RATE;
    }

    //restore the area of this buffer corresponding to the image's previous location
    (void) LCDBMPCopySub( backFrameBuf, workFrameBuf,
                 prev[index].x, prev[index].y, prev[index].x, prev[index].y, img_width, img_height,
                 pBMP_Background->biColorTable, NO_TRANSPARENCY_COLOR);
    //write the image in its new position
    (void) LCDBMPCopyTransparent( pBMP_BigR, workFrameBuf, x_pos, y_pos);

    //store previous values
    prev[index].x = x_pos;
    prev[index].y = y_pos;
    //flip buffer
    index = LCDBMP_WorkDisplay();

  }
  ExMemoryRelease(RLCD_GetTaskHandle());

  return (xDelay);
}
```

3. Touchscreen and Panel Coordinates

By convention, the sample code uses relative screen coordinates. This is accomplished by use of the "SX" and "SY" macro expansions. These expansions convert normalized coordinates (0.00 to 1.00) to absolute screen coordinates. If desired, the SX/SY macros can not be used and absolute screen coordinates used.

For example SX(0.5), SY(0.5) on a QVGA (320x240) panel would expand to (160,120)

4. Installation and Source Code Structure

The code is contained within one source file called “ScreenBounce.c,” and the bitmap images used are contained in a bitmap file “BigR.bmp”. To install the sample code, double click on the installation executable “REUE05B0107.exe” to bring up the installer. (figure 2) Make sure you click on the browse button in the “Destination Folder” Panel and select your LCD Direct Drive demo project (REU05b0112_H8SAP installation) directory. Then click the next button to copy the new files into your project directory.

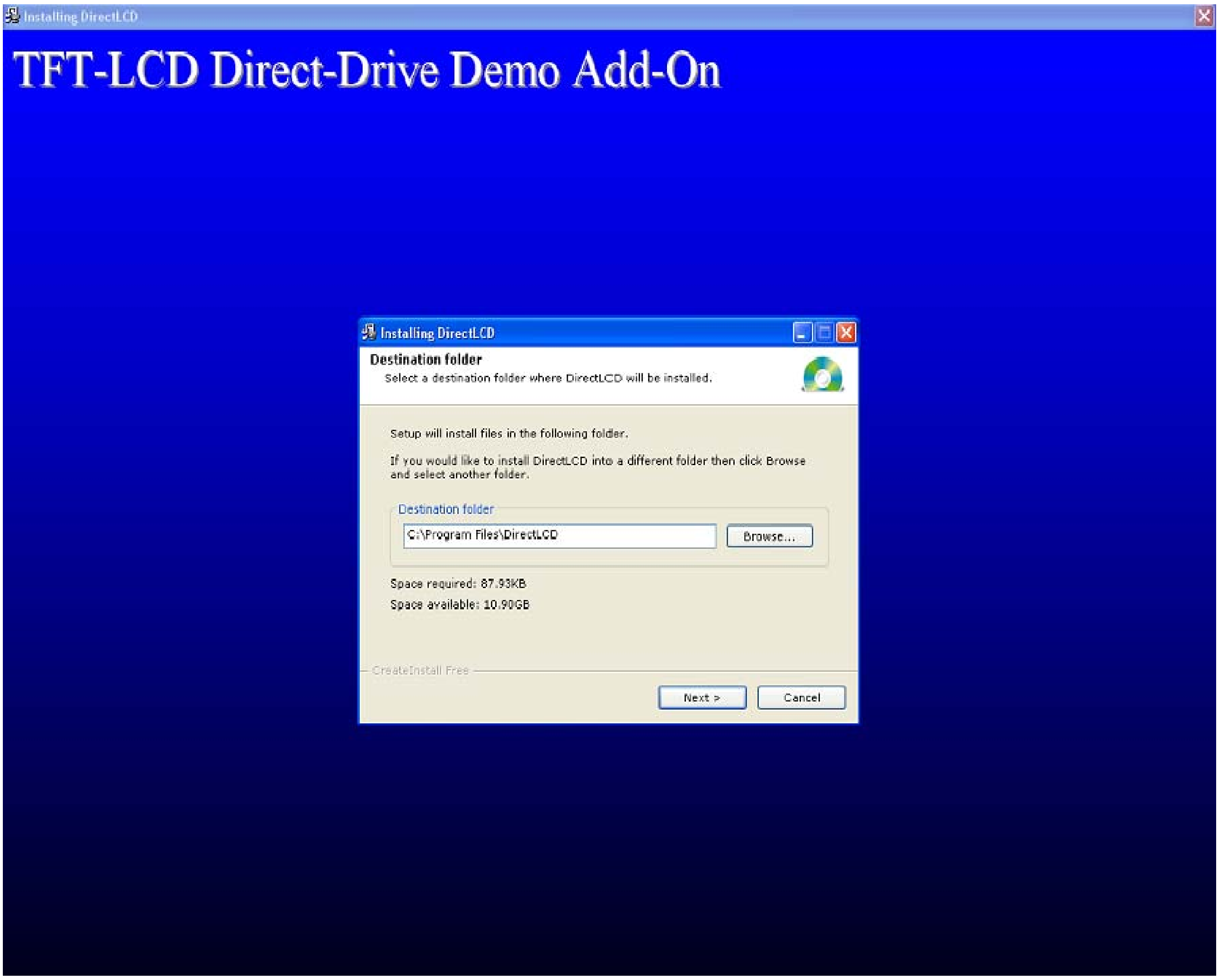


Figure 2: Installation

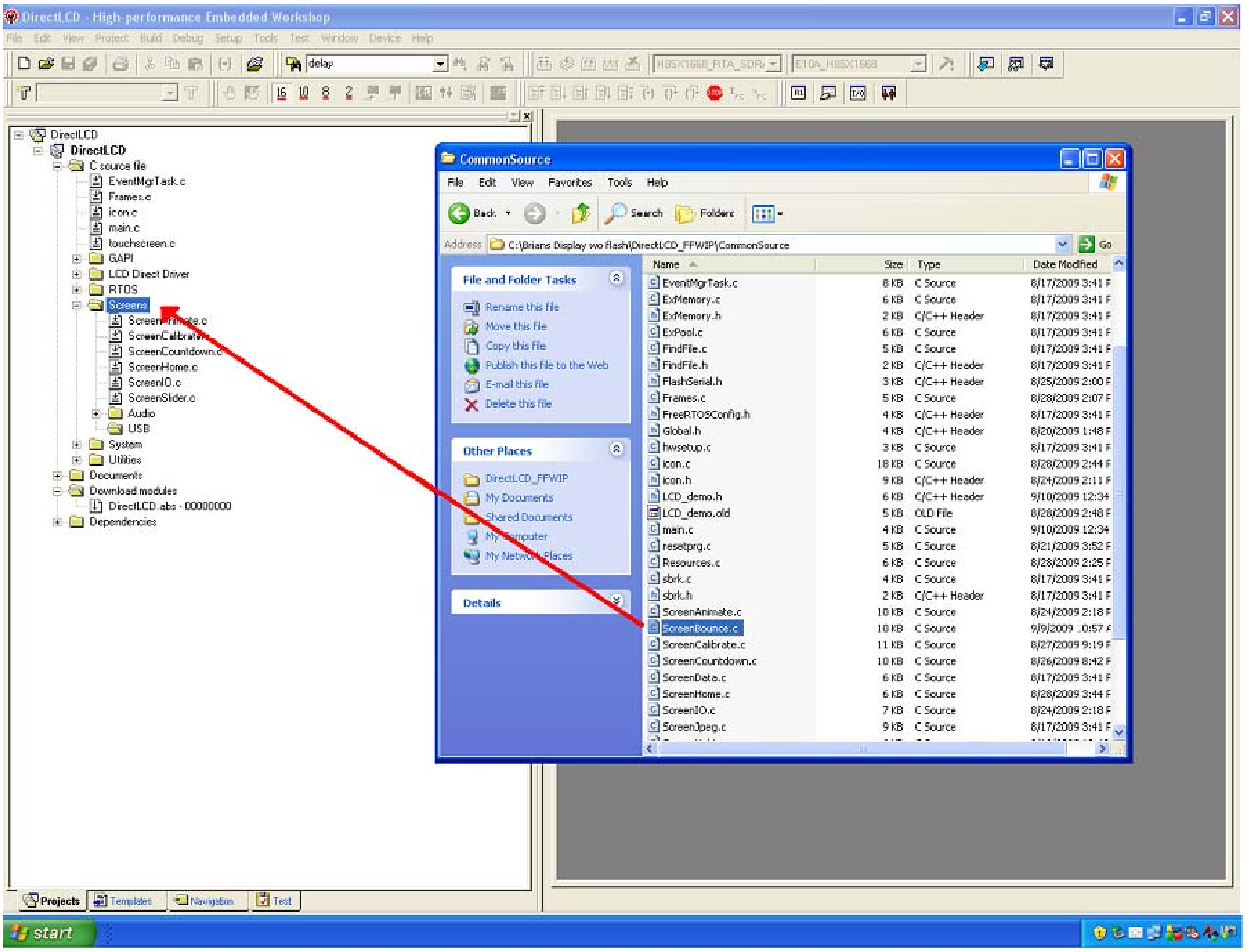


Figure 3: Adding “ScreenBounce.c” to the Direct LCD demo project in HEW

Then, open your LCD Direct Drive demo project in HEW. The ScreenBounce.c file will be located in your CommonSource directory. Add the ScreenBounce.c source file to your project in HEW by dragging the file into the Screens folder of your project. (Figure 3)

The installer places Bitmap Images that are sized for a WQVGA display panel into your resource directory by default. If you are using QVGA or VGA you will need to replace the bitmaps in your resource directory with ones of the appropriate resolution for your display panel. You will find several subdirectories in your resource folder that contain bitmaps of different resolutions. Simply copy all the files from the subdirectories corresponding to your panel resolution and paste them over the files in your resource directory.

Refer to the REU05b0112_H8SAP application note on instructions on how to build and update code resources in the target.

File Name	***File Description***
CommonSource\ScreenBounce.c	Demo screen code
Resources\BigR.bmp	Bitmap image

Website and Support

Renesas Technology Website
http://www.renesas.com/

Renesas Technology America LCD Website
http://america.renesas.com/h8lcd

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